Space Weather Forecast

Issued on Monday, 24 April 2023 at 13:32 Local

This forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Moderate or Strong geomagnetic storm/G2-G3 risk from CME (coronal mass ejection) effects continuing Day 1 (Monday 24 April) but easing. Slight chance of M-class flares (R1-R2 Minor-Moderate radio blackouts) throughout.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low over the past 24 hours, with only Common-class flares observed. There are currently six numbered sunspot regions on the visible disc. A sunspot approaching the northwest limb remains the largest grouping though slight fading observed. Its position near the limb is making classification increasingly difficult however. A active region in the southeast is the second largest and remains generally stable. The remaining sunspot regions are all small and stable, including one new and currently unnumbered sunspot region in the far southeast.

The large full-halo CME (Coronal Mass Ejection) that left the Sun at 21/1812UTC from an Moderate-class flare and associated filament eruption (arc of plasma) near center-disc arrived at Earth shortly after 23/1700 UTC. No other Earth-directed CMEs have been observed in the last 24 hours.

Solar Wind / Geomagnetic Activity: The solar wind has declined from slightly elevated to Slow levels. The associated magnetic field was stable and at weak levels until around 23/0800UTC when levels became moderate. The all-important north-south component of the field was also mostly at weak levels until late in the period when moderate levels were reached. The net effect of the above solar wind measures was for Quiet to Unsettled (Kp1-3) geomagnetic activity. The solar wind was initially at background levels, but increased significantly to Elevated or Strong levels, briefly reaching Very Strong levels, with the arrival of the CME, with a peak speed of near 800km/s observed at 23/2140 UTC. The magnetic field was initially weak, increasing to strong or very strong with the arrival of the CME. The all important north-south component (Bz) became strongly southward directed as the CME arrived.

The net effect of the above solar wind measures was initially Quiet (Kp1-2), with geomagnetic activity increasing to G1-G2 Minor-Moderate Storm (Kp5-6) observed between 23/1200-1800 UTC, strengthening to a G3-G4 Strong to Severe Storm (Kp7-8) between 23/1800-0000 UTC.

Energetic Particles / Solar Radiation: A minor solar radiation storm (S1) was observed at 23/1820 UTC due to the arrival of the CME, before declining background levels.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is most likely to continue at Low levels of activity with a slight chance of Moderate activity.

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Solar Wind / Geomagnetic Activity: Earth is currently experiencing the impacts from a CME which left the Sun on 21 Apr. Solar winds are likely to remain Elevated during day 1 (24 Apr) due to on-going CME effects, before declining to Slightly Elevated on day 2 (25 Apr), perhaps briefly reaching background levels early day 3 (26 Apr). A gradual increase back up to Elevated levels likely later on day 3 and into day 4 (26/27 Apr) due to the expected arrival of a coronal hole high speed stream.

Geomagnetic activity maintaining a chance of further G3 Strong Storm levels (Kp7) during day 1 (24 Apr) with further G1-G2 Minor-Moderate storms (Kp5-6) expected due to the on-going CME effects. Activity gradually reducing to generally Unsettled or Active intervals (Kp3-4) on day 2 (25 Apr), perhaps reaching Quiet to Unsettled intervals into day 3 as CME effects continue to wane. However, a high speed stream associated with a coronal hold later on day 3 and day 4 (26/27 Apr) likely increasing geomagnetic activity to Unsettled or Active intervals (Kp3-4), with a Chance of G1 Minor Storms (Kp 5).

Energetic Particles / Solar Radiation: A solar radiation storm (S1) has recently been observed, with a slight chance of further minor storms during day 1 (24 Apr) due to on-going CME effects.

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Geomagnetic Storms:

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	Yes	100	60	20	30
Strong	G3	Yes	50	20	1	5
Severe	G4	Yes	10	1	1	1
Extreme	G5	No	1	1	1	1

Radio Blackouts - X Ray Flares:

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	20	15	15	20
Very Active	R3 to R5 X	No	1	1	1	1

Solar Radiation Storms - (High Energy Protons):

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	Yes	10	5	5	5
Very Active	≥ S3 *	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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